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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-276458

(43)Date of publication of application : 22.10.1996

(51)Int.Cl.

B29C 45/14
G06K 19/07
// B29L 31:34

(21)Application number : 07-104619

(71)Applicant : DAINIPPON PRINTING CO LTD

(22)Date of filing : 06.04.1995

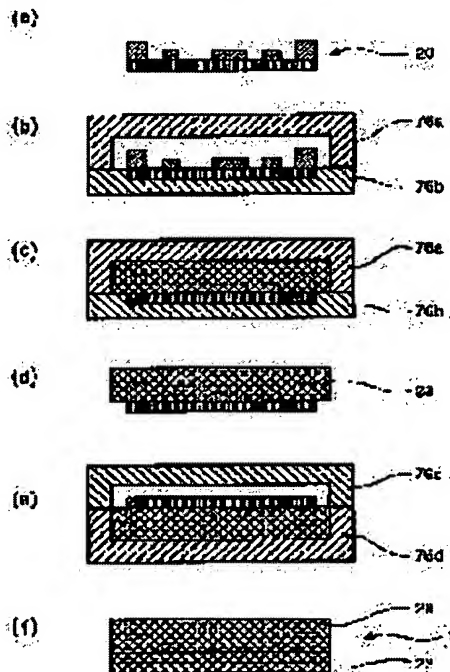
(72)Inventor : OZAKI KATSUMI

(54) MANUFACTURE OF NON-CONTACT IC TAG AND THE SAME TAG

(57)Abstract:

PURPOSE: To manufacture 8 low-cost non-contact IC tag by reducing the number of manufacturing steps of the tag.

CONSTITUTION: A method for manufacturing a non-contact IC tag comprises the steps of mounting an insert component 20 having a circuit component in molds 76a, 76b, then closing the molds, evacuating in vacuum the mold, then casting liquidlike curable resin raw material such as epoxy resin in the mold, and then curing the material by a low-pressure injection molding method.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against
examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the non-contact IC tag characterized by manufacturing by the low-pressure-injection-molding method for pouring in a liquefied hardenability resin raw material into metal mold, and stiffening this resin raw material after having made metal mold into closing after laying the insertion components which have passive circuit elements in metal mold, and making the inside of metal mold into a vacuum.

[Claim 2] The non-contact IC tag characterized by forming by the low-pressure-injection-molding method for pouring in a liquefied hardenability resin raw material into metal mold, and stiffening this resin raw material after having made metal mold into closing after laying the insertion components which have passive circuit elements in metal mold, and making the inside of metal mold into a vacuum.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] About a non-contact IC tag and its manufacture approach, especially this invention shortens a production process and relates to the cheap non-contact IC tag obtained by the manufacture approach of reducing a manufacturing cost, and this manufacture approach.

[0002]

[Description of the Prior Art] In recent years, non-contact information storage media, such as an IC card of the shape of a card type whose data communication is possible in an external data processor and non-contact with an external device, an electromagnetic wave, etc., attract attention. The non-contact IC tag of a tag configuration is in a kind of such an information storage medium. With the non-contact IC tag, making this circuit board into the appearance of a bonnet and resin mold goods in a resin case etc. is performed as a member which protects the circuit board which consists of an IC, electronic parts, etc. from the exterior, and usually supports it.

[0003] For example, as it is outline process drawing showing the manufacture approach of the conventional non-contact IC tag and is shown in this drawing, drawing 5 makes a perimeter enclosure a bonnet and a predetermined appearance configuration by injection resin, after closing the part of the electronic parts 4 of the non-contact IC component 20 which mounted IC41, a capacitor 42, and the electronic parts 4 of coil 43 grade on the printed circuit board 3 by the conventional manufacture approach using a liquefied epoxy resin. That is, drawing 5 (a) shows the non-contact IC component 20 (sectional view) obtained by mounting electronic parts 4 on a printed circuit board 3. And drawing 5 (b) shows the non-contact IC component 21 after closing the opening sections of electronic parts 4 also including a coil 43 for this non-contact IC component 20 with an epoxy resin. Thus, since the reason beforehand closed with an epoxy resin has an injection pressure in the case of injection molding of degree process, and high resin temperature, it is the 1st reason to prevent possibility that electronic parts, such as a capacitor, will be damaged. Moreover, when manufacturing at the process of only injection molding directly, it is the 2nd reason to prevent possibility that it cannot be thoroughly filled up with the opening of a non-contact IC component.

[0004] And the non-contact IC component 21 after a resin seal is laid for it in injection-molding metal mold, using an electronic-parts part like drawing 5 (b) as insertion components, for example, heating fusion is carried out, resin, such as a polyphenylene sulfide (PPS), is injection molded, and as first shown in drawing 5 (c), bottom Plastic solid 22 is formed in the lower part of the non-contact IC component 21. Next, the non-contact IC component 21 with which bottom Plastic solid 22 was formed is inserted to the injection-molding metal mold for upside shaping, is injection molded, the remaining upside one half is injection molded, and the non-contact IC tag 8 of a configuration of having been covered by injection resin is obtained from the upper and lower sides.

[0005]

[Problem(s) to be Solved by the Invention] However, with the non-contact IC tag obtained by the manufacture approach of the above conventional non-contact IC tags, and it, manufacture KOTOSU started and there was a problem that a non-contact IC tag was not obtained cheaply. That is, it is because the process of both a resin seal and injection molding was needed as only a resin seal is not made at injection molding and one process but was shown in drawing 5 from the above-mentioned reason by the manufacture approach of the conventional non-contact IC tag.

[0006] Then, the object of this invention is offering the manufacture approach which shortens a production process and may be able to be cheaply done by it, and a non-contact IC tag.

[0007]

[Means for Solving the Problem] After the manufacture approach of the non-contact IC tag of this invention made metal mold closing after laying the insertion components which have passive circuit elements in metal mold, in order to solve said technical problem and to attain the object, and it makes the inside of metal mold a vacuum, it pours in a liquefied hardenability resin raw material into metal mold, and manufactures it by the low-pressure-injection-molding method for stiffening this resin raw material.

[0008] Moreover, after the non-contact IC tag of this invention made metal mold closing after laying the insertion components which have passive circuit elements in metal mold, and it made the inside of metal mold the vacuum, it should pour in the liquefied hardenability resin raw material into metal mold, and should form it by the low-pressure-injection-molding method for stiffening this resin raw material.

[0009]

[Function] The pressure of the resin raw material poured in since the hardenability resin raw material poured in into metal mold after laying the insertion object which has passive circuit elements in shaping metal mold is liquefied can also be managed with the manufacture approach of the non-contact IC tag of this invention with low voltage, there is neither too much heating by melting resin nor breakage of the passive circuit elements by the resin-pressure force, and the reliable IC tag with which the resin raw material moreover spread even round the fine opening part is manufactured by few production processes. And the non-contact IC tag of this invention is manufactured by such manufacture approach.

[0010]

[Example] Hereafter, it explains in full detail, referring to a drawing about the manufacture approach of the non-contact IC tag of this invention, and the example of a non-contact IC tag.

[0011] The manufacture approach of the non-contact IC tag of this invention has the description in using a hardenability resin raw material liquefied as resin poured into this metal mold, using the metal mold made into a vacuum. Although there is especially no limit as a resin raw material, the low-pressure-injection-molding method which used the equipment and the raw material which are sold, for example as an example of the manufacture approach using an epoxy resin by the name which "the low-voltage liquefied injection-molding method by the liquefied epoxy resin" method ["RDGP" (trademark) (Rapid Demolding Casting Process), an alias name, and] Consists of Nagase tibia incorporated company can be used.

[0012] And drawing 2 is the outline block diagram showing an example of a series of systems of the starting low-pressure-injection-molding method. As shown in this drawing, the base resin component of the epoxy resin which is a liquefied hardenability resin raw material is stored in resin tank 71a, and the curing agent component is stored in resin tank 71b. With a pump 72, specified quantity measuring is carried out and the base resin and the curing agent of an epoxy resin are sent to a mixer 73 from the resin tanks 71a and 71b. Base resin and a curing agent are mixed by homogeneity by the mixer 73. After being mixed by the mixer 73, an epoxy resin is sent to the injection nozzle 75, and is poured in into metal mold. Metal mold consists of up metal mold 76a and lower metal mold 76b, and the non-contact IC component 20 is laid in lower metal mold 76b as insertion components. A vacuum pump 77 is connected to metal mold 76a, and after metal mold closes a vacuum pump 77, it makes the interior of metal mold a vacuum. And the base resin and the curing agent of an epoxy resin which were mixed by the mixer 73 as a liquefied hardenability resin raw material are poured in into metal mold from the injection nozzle 75, and resin is pressurized by the air compressor 74 connected to the injection nozzle 75.

[0013] Drawing 1 is outline process drawing explaining one example of the manufacture approach of the non-contact IC tag of this invention by the system of the above low-pressure-injection-molding methods. Moreover, drawing 4 is flow drawing explaining the flow of the manufacture approach of the non-contact IC tag of this invention. Hereafter, this invention is explained further in full detail, referring to drawing 1 and drawing 4.

[0014] At the beginning of the manufacture approach, metal mold is first preheated to molding

temperature as step S1. Preheat temperature is usually about 130-140 degrees C. And a release agent is applied to the parting surface of metal mold (step S2). Next, the non-contact IC component 20 shown in drawing 1 (a) as insertion components like drawing 1 (b) is laid in lower metal mold 76b (step S3). In addition, insertion components are also preheated at about 80-120 degrees C. And eye a mold clamp is performed for up metal mold 76a and lower metal mold 76b (step S4). After [mold clamp] and the inside of metal mold are made into a vacuum. In about 10 - 30 seconds, vacuum time amount performs a degree of vacuum to 1Torr extent (step S5). After are parallel to the process which makes the inside of metal mold a vacuum or making it a vacuum, the hardenability resin of the specified quantity is measured and it mixes (step S6). And liquefied hardenability resin is injected in vacuous metal mold from a injection nozzle (step S7). An injection pressure is usually 3-7kg/cm². With extent, injection and dwelling time are completed in about 150 - 200 seconds. This condition is drawing 1 (c).

[0015] after [and] hardening of resin advances until the reinforcement which can be unmolded is obtained -- a mold aperture -- carrying out (step S8) -- mold goods -- taking out (step S9) -- the half-finished products which the upper part of a non-contact IC component like drawing 1 (d) was closed with upside Plastic solid 23, and became a final appearance configuration (upper part) are obtained. It will complete, if it passes through the postcure process which carries out predetermined time heating of the resin at predetermined temperature next, and is thoroughly stiffened as a low-pressure-injection-molding method (step S10). However, in the example of this drawing, by covering only one side (upper part) of a non-contact IC component with a Plastic solid, since it is a request, a lower part also repeats from the above-mentioned step S1 to step S9 similarly, so that it may fabricate lower Plastic solid 22 by up metal mold 76c for lower Plastic solids, and 76d of lower metal mold, as shown in drawing 1 (e). And the non-contact IC tag 1 of this invention as performed postcure (step S10), made harden the Plastic solid of an upside and the bottom and shown in drawing 1 (f) is obtained. In addition, the unmolding time amount from [of metal mold / a mold clamp] to a mold aperture is usually about 240 - 300 seconds.

[0016] In addition, for example by ordinary temperature, since what is necessary is just the molding temperature of extent from which insertion components do not receive heat damage as compared with the approach using hot melting resin, such as the so-called injection molding and transfer molding mentioned later, although the epoxy resin which is liquefied thermosetting resin was used in ordinary temperature as a liquefied hardenability resin raw material in the above-mentioned example, although it is a solid-state, it may become liquefied at low temperature comparatively with about 40-50 degrees C. In this semantics, although it is a solid-state in ordinary temperature with "it being liquefied" as used in the field of this invention, what becomes liquefied is included by comparison low temperature. However, what the supply system of resin until it results in metal mold in ordinary temperature in the case of a solid-state, i.e., a resin tank, the pump, the mixer, the injection nozzle, etc. are used as equipment equipped with heating means, such as a heater which can heat resin to the temperature of the request to which resin liquefies, for is required.

[0017] In addition, drawing 3 is a plot plan which tried to have seen through the passive circuit elements inside the non-contact IC tag 1 obtained by doing in this way, and shows the condition that the printed circuit board 3 by which IC41, the capacitor 42, and the coil 43 were mounted in the interior of Plastic solid 24 has been arranged.

[0018] By the way, as an approach of using the matter liquefied as a resin raw material for closure of electronic parts, the transfer-molding method is well learned as an approach of carrying out the resin seal of the electronic parts which the so-called potting method which was explained in the column of the conventional technique, and which slushes a liquefied epoxy resin like is learned well, and were inserted using metal mold, or the circuit by melting resin. Then, the advantage of this invention is explained further, making it contrast with the trouble of these 2 approach.

[0019] First, there are the following troubles by the potting method. Usually, although an epoxy resin is used, long duration is needed for resin hardening and productivity is bad. Moreover, the bulking agent made to contain in a resin raw material sediments, it becomes uneven, and the thermo-cycle engine performance falls. The content of a bulking agent cannot be made [many]. It is easy to be influenced of the humidity in atmospheric air. From such a point, it is not used in a configuration [having closed], and a closure object needs to surely enclose in a case.

[0020] Next, there are the following troubles by the transfer-molding method. Since it is the approach of injection molding in metal mold after dissolving a resin raw material solid in ordinary temperature immediately before, molding temperature is high (150 degrees C or more), and compacting pressure is also high (50-200kg/cm²). There is a possibility that components may be damaged in this elevated temperature and high voltage. Moreover, a resin raw material does not advance between fine openings, for example, the line of a coil component. Therefore, with components with a complicated configuration, it is easy to generate poor shaping. Since heat and pressure are used, application to impregnation down stream processing is impossible. Cold storage is required to keep a resin raw material, a production control top is also troublesome, and the degree of freedom of selection is narrow also in an ingredient presentation side.

[0021] As mentioned above, there are various troubles in the potting method and the transfer-molding method which are conventionally learned well as the closure approach of electronic parts, and it comes by manufacture of the conventional non-contact IC tag to them there as the manufacture approach which combined the potting method and the injection-molding method with the above mentioned appearance. However, with the above mentioned injection molding of PPS (polyphenylene sulfide), it is 500-1000kg/cm². It was high voltage, and since 300 degrees C and an elevated temperature were required, there were problems, like preliminary closure requires.

[0022] On the other hand, by the manufacture approach of the non-contact IC tag of this invention, in order to consider as the approach of pouring in a resin raw material liquefied as mentioned above into metal mold, the conventional various troubles are solved and it becomes the approach of shortening a production process.

[0023] That is, according to the manufacture approach of this invention, before pouring in the point which uses a hardenability resin raw material liquefied as a resin raw material, and resin, the following advantages are acquired with the point which makes the inside of a mold the vacuum. First, high voltage is unnecessary (an injection pressure is 2-7kg/cm² extent), since it is the liquefied vacuum injection molding low temperature is sufficient also as whose temperature (a die temperature is about 130-160 degrees C), a resin raw material is advanced to a fine opening, and a coil component etc. can sink in. There is little breakage on components. Therefore, the components of a complicated configuration can also respond. Moreover, since a moldings can be used as a case, it is not necessary to prepare a case separately and case shaping can be made simultaneous with a resin seal. The setting time of resin can be shortened. The degree of freedom of the selection in respect of an ingredient presentation is large. It can fabricate, even if it makes [many] the content of a bulking agent. Therefore, by selecting a resin raw material, the engine performance of the mold goods obtained can improve thermal shock nature, fire retardancy, etc., and cannot be easily influenced of the humidity in atmospheric air. And since the mold goods by hardenability resin itself satisfy the engine performance as a case, closure and case shaping can be performed at one process, the number of production processes reduces, and a manufacturing cost also falls.

[0024] as mentioned above -- although ordinary temperature has explained as an example the epoxy resin which is liquefied thermosetting resin -- such an epoxy resin -- carrying out -- the non-contact IC tag of the physical properties which were excellent with the epoxy resin (for example, base resin XNR-8205 and curing agent XNH-8205) currently sold by said Nagase tibia incorporated company is obtained. However, that this invention should just be a resin raw material with which it is not limited to these epoxy resins, and it is a liquefied hardenability resin raw material in ordinary temperature, a resin seal is satisfied, and a moldings possesses the physical properties as a case, a hardening means may not be limited to heat and may be concomitant use with means other than heat and heat.

[0025] Moreover, although the non-contact IC tag which is the obtained mold goods remains as it is and you may use it, an alphabetic character, a graphic form, a pattern, etc. may be further formed in a mold-goods front face like a printer with a well-known printing means. For example, according to the so-called underwater curved-surface-printing method which floats on water the imprint film which printed the pattern etc. to the water soluble film beforehand, presses mold goods from on the film which floated, and imprints a pattern, a pattern etc. can be freely formed also in the tag of a curved-surface configuration.

[0026] Moreover, display devices, such as a liquid crystal display component and a reversible display device by the macromolecule / fatty-acid bipolar membrane, are included in the non-contact

IC tag, and it is good for it also as with a display function. It is drawing of longitudinal section showing an example of the non-contact IC tag which are other examples of this invention which included the rewriting display device in which a reversible display is possible in drawing 6. The non-contact IC tag 1 of this drawing has a circular flat-surface configuration, and the rewriting display 5 which becomes a top face from the rewriting display device in which a rewriting display is possible is the thing of the structure where the fixed display 6 which indicated notes, such as a usage, was formed in the rear face.

[0027] Drawing 7 and drawing 8 show the manufacture process of the body of the non-contact IC tag shown in above-mentioned drawing 8. Drawing 7 inserts the non-contact IC component 20 into metal mold 76a and 76b. It is the process explanatory view showing the place which injection molds upside Plastic solid 23, and drawing 8 is a process explanatory view which inserts the upside molding object 23 acquired at the process of drawing 7 in metal mold 76c and 76d, injection molds bottom Plastic solid 22, and manufactures the body of a non-contact IC tag.

[0028] If the crevice which sticks a label gets down to the front flesh side of the body of a non-contact IC tag with the circular flat-surface configuration acquired as mentioned above, the rewriting display device made into the shape of a crevice label by the side of a front face is stuck and the pressure sensitive adhesive label made from a polyethylene terephthalate film (total thickness of 150 micrometers) which printed notes etc. is stuck on the crevice by the side of a rear face, a non-contact IC tag as shown in drawing 6 will be obtained. In addition, the rewriting display device which for example, magnetic powder is made to float into the liquid in a microphone capsule, controls the orientation condition of magnetic powder by the magnetic field, and consists of a magnetic microcapsule layer in which a reversible display is possible is used for the rewriting display 5. Specifically, the label (total thickness of 400 micrometers) which carried out sequential formation of a magnetic microcapsule layer, a black printing layer, and the binder layer is stuck on the transparence base material which consists of a transparence polyethylene terephthalate film. The display written in a magnetic microcapsule layer is the configuration of spacing and seeing a transparence base material. In addition, it is the same side where the label right face after label attachment and the front face of the body of a non-contact IC tag have the same abbreviation height, and is made to have exfoliated a label and to have not damaged it easily, from the edge.

[0029]

[Effect of the Invention] By the manufacture approach of the non-contact IC tag of this invention, the number of production processes is shortened and a manufacturing cost decreases. Moreover, with the non-contact IC tag of this invention, since it is IC tag manufactured by the above manufacture approaches, cheap IC tag is obtained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The process explanatory view of one example of the manufacture approach of the non-contact IC tag of this invention.

[Drawing 2] The outline block diagram of the system of the low-pressure-injection-molding method of one example of the manufacture approach of this invention.

[Drawing 3] The plot plan explaining the interior of the non-contact IC tag of this invention.

[Drawing 4] Flow drawing explaining the flow of the manufacture approach of this invention.

[Drawing 5] The process explanatory view of the manufacture approach of the conventional non-contact IC tag.

[Drawing 6] Drawing of longitudinal section explaining the example of a configuration of the non-contact IC tag of this invention.

[Drawing 7] The process explanatory view of an example of the manufacture approach of this invention (shaping of an upside molding object).

[Drawing 8] The process explanatory view of an example of the manufacture approach of this invention (shaping of a bottom molding object).

[Description of Notations]

- 1 Non-contact IC Tag
 - 20 Non-contact IC Component
 - 21 Non-contact IC Component after Resin Seal
 - 22 Bottom Plastic Solid
 - 23 Upside Plastic Solid
 - 24 Plastic Solid
 - 3 Printed Circuit Board
 - 4 Passive Circuit Elements
 - 41 IC
 - 42 Capacitor
 - 43 Coil
 - 44 Epoxy Resin
 - 5 Rewriting Display
 - 6 Fixed Display
 - 71a Resin tank (base resin)
 - 71b Resin tank (curing agent)
 - 72 Pump
 - 73 Mixer
 - 74 Air Compressor
 - 75 Injection Nozzle
 - 76a, 76c Up metal mold
 - 76b, 76d Lower metal mold
 - 77 Vacuum Pump
 - 8 The Conventional Non-contact IC Tag
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[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-276458

(43) 公開日 平成 8 年 (1996) 10 月 22 日

(51) Int.Cl. ⁸	識別記号	庁内整理番号	F I	技術表示箇所
B 2 9 C 45/14		9543-4F	B 2 9 C 45/14	
G 0 6 K 19/07			G 0 6 K 19/00	H
// B 2 9 L 31:34				

審査請求 未請求 請求項の数 2 F D (全 6 頁)

(21) 出願番号 特願平7-104619

(22) 出願日 平成 7 年 (1995) 4 月 6 日

(71) 出願人 000002897

大日本印刷株式会社

東京都新宿区市谷加賀町一丁目 1 番 1 号

(72) 発明者 尾崎 勝美

東京都新宿区市谷加賀町一丁目 1 番 1 号

大日本印刷株式会社内

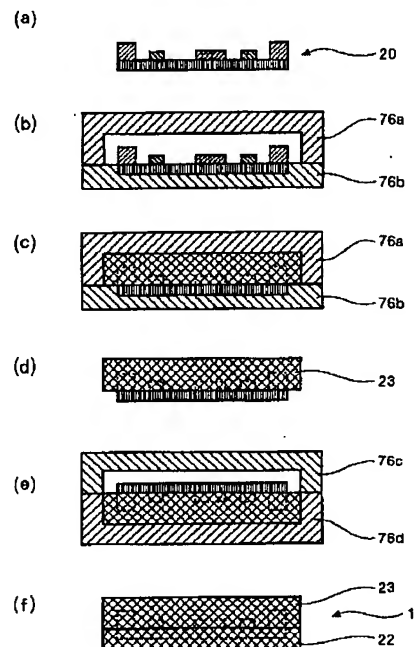
(74) 代理人 弁理士 小西 淳英

(54) 【発明の名称】 非接触 I C タグの製造方法及び非接触 I C タグ

(57) 【要約】

【目的】 非接触 I C タグの製造工程数を少なくし、安価に製造する。

【構成】 製造方法は、金型 (76 a, 76 b) 内に回路部品を有するインサート部品 (20) を載置した後、金型を閉じ、金型内を真空にした後、エポキシ樹脂等の液状の硬化性樹脂原料を金型内に注入し、該樹脂原料を硬化させる低圧射出成形法により製造する。



【特許請求の範囲】

【請求項 1】 金型内に回路部品を有するインサート部品を載置した後、金型を閉じ、金型内を真空にした後、液状の硬化性樹脂原料を金型内に注入し、該樹脂原料を硬化させる低圧射出成形法により製造することを特徴とする非接触 IC タグの製造方法。

【請求項 2】 金型内に回路部品を有するインサート部品を載置した後、金型を閉じ、金型内を真空にした後、液状の硬化性樹脂原料を金型内に注入し、該樹脂原料を硬化させる低圧射出成形法により形成したことを特徴とする非接触 IC タグ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、非接触 IC タグとその製造方法に関し、特に、製造工程を短縮し、製造コストを低減する製造方法と、該製造方法によって得られる安価な非接触 IC タグに関する。

【0002】

【従来の技術】近年、外部装置と電磁波等により外部データ処理装置と非接触でデータ通信ができるカード形状の IC カード等の非接触情報記憶媒体が注目されている。このような情報記憶媒体の一種にタグ形状の非接触 IC タグがある。非接触 IC タグでは、通常、IC、電子部品等からなる回路基板を外部から保護し支持する部材として、該回路基板を樹脂ケースで覆い、樹脂成形品の外観とすること等が行われている。

【0003】例えば、図 5 は従来の非接触 IC タグの製造方法を示す概略工程図であり、同図に示す如く、従来の製造方法では、プリント基板 3 上に IC 41、コンデンサ 42、コイル 43 等の電子部品 4 を実装した非接触 IC コンポーネント 20 の電子部品 4 の部分を液状のエポキシ樹脂を用いて封止した後、全周囲を射出樹脂で覆い且つ所定の外形形状とするものである。すなわち、図 5 (a) は、電子部品 4 をプリント基板 3 上に実装して得られた非接触 IC コンポーネント 20 (の断面図)を示す。そして、図 5 (b) は、この非接触 IC コンポーネント 20 を、コイル 43 も含めて電子部品 4 の空隙部をエポキシ樹脂で封止した後の非接触 IC コンポーネント 21 を示す。このようにエポキシ樹脂で予め封止する理由は、次工程の射出成形の際の射出圧力、樹脂温度が高いために、コンデンサ等の電子部品が破損する可能性を防止することが第 1 の理由である。また、直接に射出成形だけの工程で製造する場合には、非接触 IC コンポーネントの空隙を完全に充填できない可能性を防止することが第 2 の理由である。

【0004】そして、図 5 (b) の様な電子部品部分を樹脂封止後の非接触 IC コンポーネント 21 をインサート部品として射出成形金型内に載置して、例えばポリフェニレンスルフィド (PPS) 等の樹脂を加熱溶解して射出成形して、先ず図 5 (c) に示す様に、下側成形体

22 を非接触 IC コンポーネント 21 の下部に形成する。次に、下側成形体 22 が形成された非接触 IC コンポーネント 21 を、上側成形用の射出成形金型にインサートして射出成形して、残りの上側半分を射出成形し、上下から射出樹脂で覆われた構成の非接触 IC タグ 8 が得られる。

【0005】

【発明が解決しようとする課題】しかしながら、上述の様な従来の非接触 IC タグの製造方法及びそれによって得られる非接触 IC タグでは、製造コストがかかり、安価に非接触 IC タグが得られないという問題があった。すなわち、従来の非接触 IC タグの製造方法では、樹脂封止のみ、或いは射出成形のみと一工程では出来ず、上記の理由から図 5 に示したように樹脂封止及び射出成形の両方の工程を必要としたからである。

【0006】そこで、本発明の目的は、製造工程を短縮し、それによって、安価にできる製造方法、及び非接触 IC タグを提供することである。

【0007】

【課題を解決するための手段】本発明の非接触 IC タグの製造方法は、前記課題を解決し目的を達成するために、金型内に回路部品を有するインサート部品を載置した後、金型を閉じ、金型内を真空にした後、液状の硬化性樹脂原料を金型内に注入し、該樹脂原料を硬化させる低圧射出成形法により製造するようにしたものである。

【0008】また、本発明の非接触 IC タグは、金型内に回路部品を有するインサート部品を載置した後、金型を閉じ、金型内を真空にした後、液状の硬化性樹脂原料を金型内に注入し、該樹脂原料を硬化させる低圧射出成形法により形成したものとす。

【0009】

【作用】本発明の非接触 IC タグの製造方法では、成形金型に回路部品を有するインサート物を載置後に、金型内に注入される硬化性樹脂原料が液状のものであるので、注入される樹脂原料の圧力も低圧で済み、熔融樹脂による過度の加熱や樹脂圧力による回路部品の破損がなく、しかも、細かい空隙部分にまで樹脂原料が行き渡った信頼性の高い IC タグが、少ない製造工程で製造される。そして、本発明の非接触 IC タグはこのような製造方法によって製造される。

【0010】

【実施例】以下、本発明の非接触 IC タグの製造方法及び非接触 IC タグの実施例について図面を参照しながら詳述する。

【0011】本発明の非接触 IC タグの製造方法は、真空中にできる金型を用い、また、該金型に注入する樹脂として液状の硬化性樹脂原料を用いることに特徴がある。樹脂原料としては特に制限はないが、例えば、エポキシ樹脂を用いた製造方法の具体例として、長瀬チバ株式会社より「RDCP」(登録商標) (Rapid Dem

olding Casting Process)、別名、「液状エポキシ樹脂による低圧液状射出成形法」なる名称で販売されている装置及び原料を使用した低圧射出成形法が使用できる。

【0012】そして、図2は、係る低圧射出成形法の一連のシステムの一例を示す概略構成図である。同図の如く、液状の硬化性樹脂原料であるエポキシ樹脂の主剤成分は樹脂タンク71aに貯蔵し、硬化剤成分は樹脂タンク71bに貯蔵しておく。エポキシ樹脂の主剤及び硬化剤はポンプ72によって所定量計量され樹脂タンク71a及び71bからミキサー73に送られる。ミキサー73で主剤及び硬化剤は均一に混合される。ミキサー73で混合された後、エポキシ樹脂は射出ノズル75に送られ、金型内に注入される。金型は上部金型76a及び下部金型76bで構成され、下部金型76bにインサート部品として非接触ICコンポーネント20が載置される。金型76aには真空ポンプ77が接続され、真空ポンプ77は金型が閉じた後に金型内部を真空にする。そして、液状の硬化性樹脂原料としてミキサー73で混合されたエポキシ樹脂の主剤及び硬化剤が射出ノズル75から金型内に注入され、射出ノズル75に接続された空気圧縮機74により樹脂は加圧される。

【0013】図1は、上記のような低圧射出成形法のシステムによる、本発明の非接触ICタグの製造方法の一実施例を説明する概略工程図である。また、図4は、本発明の非接触ICタグの製造方法の流れを説明するフロー図である。以下、図1及び図4を参照しながら、さらに本発明を詳述する。

【0014】製造方法の最初は、先ずステップS1として、金型を成形温度に予熱しておく。予熱温度は通常130〜140℃程度である。そして、金型のパーティング面に離型剤を塗布する(ステップS2)。次に、図1(b)の様にインサート部品として図1(a)に示す非接触ICコンポーネント20を下部金型76bに載置する(ステップS3)。なお、インサート部品も80〜120℃程度に予熱しておく。そして、上部金型76aと下部金型76bとを型締めを行う(ステップS4)。型締め後、金型内を真空にする。真空時間は10〜30秒程度で、真空度は1 Torr程度まで行う(ステップS5)。金型内を真空にする工程と平行して、或いは真空にした後、所定量の硬化性樹脂を計量し、混合する(ステップS6)。そして、射出ノズルから真空の金型内に液状の硬化性樹脂を射出する(ステップS7)。射出圧力は通常3〜7 kg/cm²程度で、射出・保圧時間は150〜200秒程度で完了する。この状態が図1(c)である。

【0015】そして、脱型が可能な強度が得られるまで樹脂の硬化が進行した後に型開きし(ステップS8)、成形品を取出す(ステップS9)と、図1(d)のような非接触ICコンポーネントの上側部分が上側成形体2

3で封止され且つ最終的な外形形状(上側部分)となった半製品が得られる。低圧射出成形法としては、この後に樹脂を所定温度で所定時間加熱して完全に硬化させる後硬化工程を経れば(ステップS10)、完了する。ただ、同図の実施例では、非接触ICコンポーネントの片面(上側部分)のみが成形体で覆われたのみであるから、下側部分も同様に、図1(e)に示す様に、下部成形体用の上部金型76c及び下部金型76dにより下部成形体22を成形するべく、上記ステップS1からステップS9までを繰り返す。そして、後硬化を行い(ステップS10)上側及び下側の成形体を硬化させて図1(f)に示す様な本発明の非接触ICタグ1が得られる。なお、金型の型締めから型開き迄の脱型時間は通常240〜300秒程度である。

【0016】なお、上記の実施例では、液状の硬化性樹脂原料として、常温で液状の熱硬化性樹脂であるエポキシ樹脂を用いたが、いわゆる射出成形や後述するトランスファ成形等の高温の熔融樹脂を用いる方法と比較して、インサート部品が熱損傷を受けない程度の成形温度であれば良いのであるから、例えば常温では固体だが40〜50℃程度と比較的低温で液状となるものでも構わない。この意味で、本発明でいう「液状」とは常温では固体だが比較的低温で液状となるものも包含する。但し、常温で固体の場合は、金型に至るまでの樹脂の供給系、すなわち、樹脂タンク、ポンプ、ミキサー、射出ノズル等は樹脂が液状化する所望の温度まで樹脂を加熱できるヒータ等の加熱手段を備えた装置としておくことは必要である。

【0017】なお、図3はこのようにして得られる非接触ICタグ1の内部の回路部品を透視した見た配置図であり、成形体24の内部にIC41、コンデンサ42及びコイル43が実装されたプリント基板3が配置された状態を示す。

【0018】ところで、樹脂原料として液状の物質を電子部品の封止に用いる方法としては、従来技術の欄で説明した様に液状エポキシ樹脂を流し込む、いわゆる、ポッティング法が良く知られており、また、金型を用いてインサートされた電子部品や回路を熔融樹脂で樹脂封止する方法としては、トランスファ成形法が良く知られている。そこで、これら2方法の問題点と対比させつつ、本発明の利点についてさらに説明する。

【0019】先ず、ポッティング法では、以下のような問題点がある。通常エポキシ樹脂を使用するが、樹脂硬化に長時間を必要とし生産性が悪い。また、樹脂原料中に含有させる充填剤が沈降して不均一となり、ヒートサイクル性能が低下する。充填剤の含有量を多くできない。大気中の湿度の影響を受けやすい。このような点から、封止したままの形状で使用するのではなく、封止物は必ずケースで囲うことが必要である。

【0020】次に、トランスファ成形法では、以下のよ

うな問題点がある。常温で固形の樹脂原料を直前に融解してから金型内に射出成形する方法であるために、成形温度が高く（150℃以上）、また成形圧力も高い（50～200kg/cm²）。この高温、高压で部品が損傷する恐れがある。また、細かい空隙、例えば、コイル部品の線間に樹脂原料が進入しない。従って、形状の複雑な部品等では成形不良が発生し易い。熱圧を利用するため含浸処理工程への適用が不可能である。樹脂原料を保管するのに冷蔵庫が必要で工程管理上も面倒で、材料組成面でも選択の自由度が狭い。

【0021】以上の様に、従来より電子部品の封止方法として良く知られているポッティング法及びトランスファ成形法には、各種問題点があり、そこで、従来の非接触ICタグの製造では、前記した様にポッティング法と射出成形法を組み合わせた製造方法としてきたものである。しかし、前記したPPS（ポリフェニレンスルフィド）の射出成形では500～1000kg/cm²と高压で、且つ、300℃と高温が必要であるために、予備封止が要する等の問題があった。

【0022】これに対して、本発明の非接触ICタグの製造方法では、上述のように液状の樹脂原料を金型内に注入する方法とするために、従来の種々の問題点を解決し、製造工程を短縮できる方法となる。

【0023】すなわち、本発明の製造方法によれば、樹脂原料として液状の硬化性樹脂原料を使用する点、及び樹脂を注入する前に型内を真空にしておく点等によって次の様な利点が得られるものである。先ず、高压が不要であり（射出圧力は2～7kg/cm²程度）、温度も低温で良い（金型温度は130～160℃程度）液状真空射出成形であるために細かい空隙まで樹脂原料を進入し、コイル部品等も含浸できる。部品の損傷が少ない。従って、複雑な形状の部品でも対応できる。また、成形物をケースとして使用できるので、別途ケースを用意する必要がなく、樹脂封止とケース成形を同時にできる。樹脂の硬化時間が短縮できる。材料組成面での選択の自由度が大きい。充填剤の含有量を多くしても成形できる。従って、得られる成形品の性能は樹脂原料を選定することによって熱衝撃性や難燃性等も改善でき、また、大気中の湿度の影響を受けにくい。そして、硬化性樹脂による成形品そのものがケースとしての性能を満足するので、封止、ケース成形を一工程ででき、製造工程数が削減し製造コストも低下する。

【0024】以上、常温で液状の熱硬化性樹脂であるエポキシ樹脂を具体例として説明してきたが、このようなエポキシ樹脂としては、前記長瀬チバ株式会社より販売されているエポキシ樹脂（例えば、主剤XNR-8205及び硬化剤XNH-8205）等により優れた物性の非接触ICタグが得られる。しかし、本発明はこれらエポキシ樹脂に限定されるものではなく、その他、常温で液状の硬化性樹脂原料で、樹脂封止を満足し、且つ成形

物がケースとしての物性を具備する樹脂原料であれば良く、また、硬化手段は熱に限定されるものではなく、熱と熱以外の手段との併用であっても良い。

【0025】また、得られた成形品である非接触ICタグはそのまま使用しても良いが、さらに、印刷工程を加えて、成形品表面に文字や図形、模様等を公知の印刷手段により形成してもよい。例えば、予め水性フィルムに絵柄等を印刷した転写フィルムを水に浮かべて、浮いたフィルムの上から成形品を押し当てて絵柄を転写する、いわゆる水中曲面印刷法によれば、曲面形状のタグへも自由に絵柄等を形成できる。

【0026】また、非接触ICタグには、液晶表示素子や、高分子/脂肪酸複合膜による可逆表示素子等の表示素子を組み込んでおき、表示機能付きとしても良い。図6に、可逆的な表示が可能な書換表示素子を組み込んだ、本発明の他の実施例である非接触ICタグの一例を示す縦断面図である。同図の非接触ICタグ1は、平面形状が円形のものであり、上面には書換表示可能な書換表示素子からなる書換表示部5が、裏面には使用法等の注意書きを記載した固定表示部6が設けられた構造のものである。

【0027】図7及び図8は、上記図8に示す非接触ICタグの本体の製造過程を示し、図7は金型76a及び76b内に非接触ICコンポーネント20を挿入し、上側成形体23を射出成形するところを示す工程説明図であり、図8は金型76c及び76d内に図7の工程で得られた上側成型体23を挿入し、下側成形体22を射出成形して、非接触ICタグ本体を製造するところの工程説明図である。

【0028】以上の様にして得られた平面形状が円形の非接触ICタグ本体の表裏にはラベルを貼する凹部があり、表面側の凹部ラベル状にした書換表示素子を貼着し、裏面側の凹部には注意書き等を印刷したポリエチレンテレフタレートフィルム製の粘着ラベル（総厚150μm）を貼着すれば、図6に示すような非接触ICタグが得られる。なお、書換表示部5には、例えば、磁性粉をマイクロカプセル中の液体に浮遊させて磁場により磁性粉の配向状態を制御して可逆的な表示が可能な磁気マイクロカプセル層からなる書換表示素子を使用する。具体的には、透明ポリエチレンテレフタレートフィルムからなる透明基材上に磁気マイクロカプセル層、黒色印刷層、粘着剤層を順次形成したラベル（総厚400μm）を貼着する。磁気マイクロカプセル層に書き込まれる表示は透明基材を透して見る構成である。なお、ラベル貼着後のラベルおもて面と非接触ICタグ本体の表面とは略高さが同じ同一面となっており、ラベルがその端部から容易に剥離や破損しない様にしてある。

【0029】

【発明の効果】本発明の非接触ICタグの製造方法では、製造工程数が短縮され、製造コストが低減する。ま

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た、本発明の非接触ＩＣタグでは、上記の様な製造方法によって製造されたＩＣタグであるので、安価なＩＣタグが得られる。

【図面の簡単な説明】

【図１】本発明の非接触ＩＣタグの製造方法の一実施例の工程説明図。

【図２】本発明の製造方法の一実施例の低圧射出成形法のシステムの概略構成図。

【図３】本発明の非接触ＩＣタグの内部を説明する配置図。

【図４】本発明の製造方法のフローを説明するフロー図。

【図５】従来の非接触ＩＣタグの製造方法の工程説明図。

【図６】本発明の非接触ＩＣタグの形状例を説明する縦断面図。

【図７】本発明の製造方法の一例の工程説明図（上側成型体の成形）。

【図８】本発明の製造方法の一例の工程説明図（下側成型体の成形）。

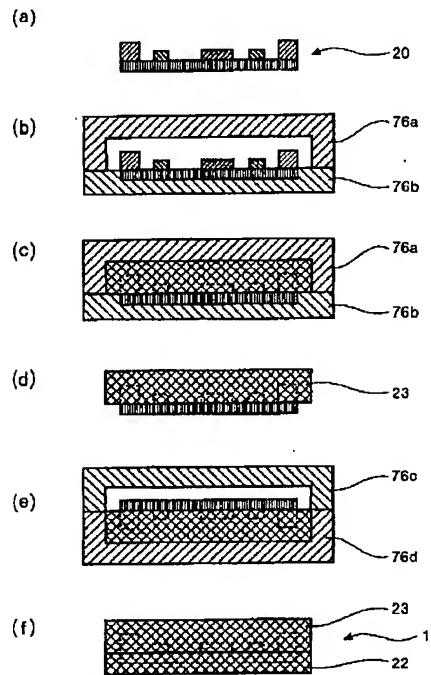
【符号の説明】

- 1 非接触ＩＣタグ
20 非接触ＩＣコンポーネント

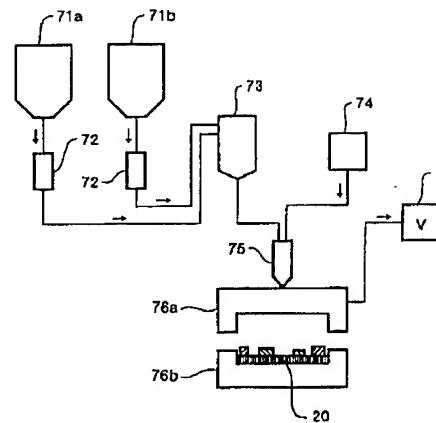
8

- 21 樹脂封止後の非接触ＩＣコンポーネント
22 下側成型体
23 上側成型体
24 成型体
3 プリント基板
4 回路部品
41 ＩＣ
42 コンデンサ
43 コイル
44 エポキシ樹脂
5 書換表示部
6 固定表示部
71a 樹脂タンク（主剤）
71b 樹脂タンク（硬化剤）
72 ポンプ
73 ミキサー
74 空気圧縮機
75 射出ノズル
76a, 76c 上部金型
76b, 76d 下部金型
77 真空ポンプ
8 従来の非接触ＩＣタグ

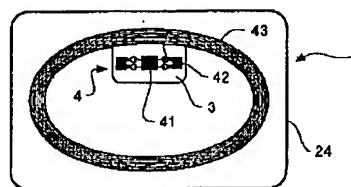
【図１】



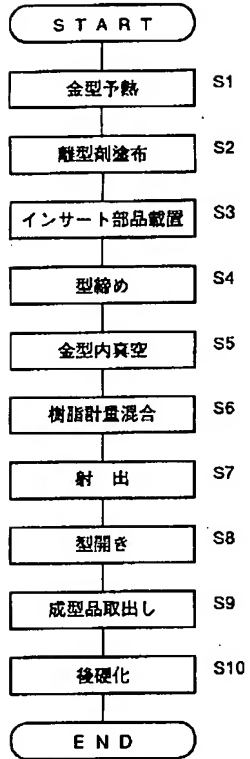
【図２】



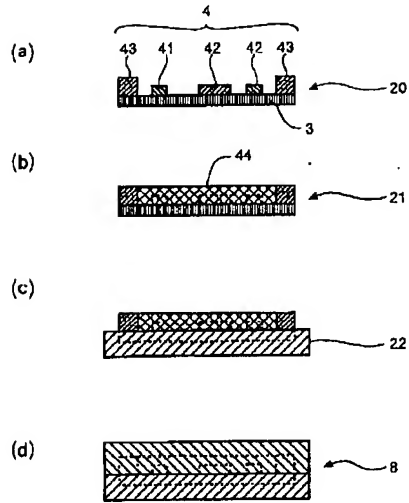
【図３】



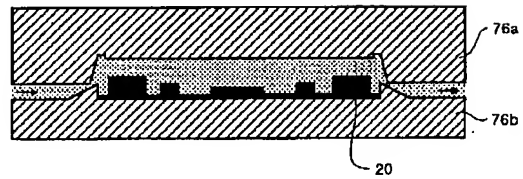
【図 4】



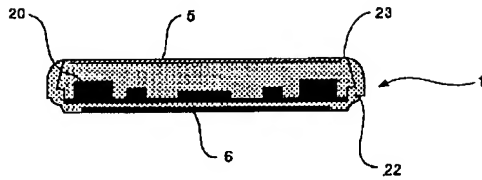
【図 5】



【図 7】



【図 6】



【図 8】

